# A Randomized Trial of Education to Prevent Lead Burden in Children at High Risk for Lead Exposure: Efficacy as Measured by Blood Lead Monitoring

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**In this article we report on the effectiveness of a community-based, culture-specific, controlled trial of intensive peer education aimed at preventing lead burden in children 0–36 months of age within a neighborhood with high risk for lead exposure. Mothers ($n$ = 594) were randomly assigned to control or intervention groups. Offspring blood lead levels were assessed every 4 months. All participants received brochures on basic lead prevention strategies. Intervention participants were offered 20 bi-weekly educational sessions by same-ethnicity peer educators over the course of 1 year, and quarterly booster sessions for 2 years afterward. The intervention group's educational curriculum included information on lead sources (e.g., paint, dust, water, soil, and risks from home repairs and remodeling), health consequences of lead burden, and strategies to reduce lead exposure, including household cleaning, hygiene, safe use of water, and nutritional recommendations. Results indicated that of the 378 children contributing sufficient blood data for analysis, 23% had blood lead levels > 10 µg/dL before 3 years of age. Intervention participants were more likely to maintain blood lead levels < 10 µg/dL than were controls (81% vs. 73%; $p$ = 0.08). Multivariate analyses demonstrated that the intervention reduced the risk of blood lead levels > 10 µg/dL by approximately 34%. We conclude that although intensive education resulted in a lower proportion of children with elevated lead levels, education alone cannot be relied upon to prevent lead burden. *Key words:* lead burden, lead poisoning, peer education, prevention, primary prevention. *Environ Health Perspect* 111:1947–1951 (2003). doi:10.1289/ehp.6352 available via *http://dx.doi.org/* [Online 2 September 2003]**

Childhood lead burden is one of the most common and preventable environmental health problems. Rates vary depending on socioeconomic status and geographical location, but estimates for populations at risk are typically near 25% (Casey et al. 1996; CDC 2001; Javier et al. 1999; Nordin et al. 1998; Rifai et al. 1993; Singer et al. 1997). Although lead burden rates have declined dramatically since lead was removed from paint in 1978 and phased out of gasoline beginning in 1973 (Lanphear et al. 2003), many children are still poisoned, in part because these earlier practices still pose risks. Today, children living in homes built before 1978 are exposed to lead paint as it deteriorates, particularly on walls and windows damaged by moisture from leaks. Children play in bare soil contaminated by leaded gasoline emission deposits. Soil tracked into the house and deteriorating paint from interior walls and windows create lead in household dust. Children ingest dust as they crawl or play on the floor and put dusty hands in their mouths. In addition, water from lead pipes and copper pipes with lead solder continues to pose a risk in some communities (Lanphear et al. 1998, 2002). Children of certain ethnicities are also exposed through pottery glaze and traditional lead-laden medicinals (CDC 2002; Tait et al. 2002).

Low to moderate blood lead levels can lead to lowered IQ (Baghurst et al. 1992; Bellinger et al. 1991, 1992; Bergomi et al. 1989; Dietrich et al. 1993) and to deficits in attention (Walkowiak et al. 1998; Winneke and Kramer 1997), visuospatial and visuomotor skills (Bellinger et al. 1991; Dietrich et al. 1991; Winneke et al. 1994), language (Shaheen 1984), and reading (Fergusson et al. 1997), as well as generally poor academic achievement (Bellinger et al. 1992; Lanphear et al. 2000a; Wang et al. 2002) and hyperactivity, aggression, and emotional lability (Bellinger et al. 1994). Adolescents with prior lead burden commit more delinquent acts than do nonburdened adolescents (Dietrich et al. 2001; Needleman et al. 1996, 2002). Some of these developmental consequences may be permanent, leading to lost potential and unnecessary spending on special education and the justice system (Bellinger et al. 1992; Liu et al. 2002; Needleman et al. 1985, 1990; Tong et al. 1998). Although the current Centers for Disease Control and Prevention guidelines place the safe limit at 10 µg/dL (CDC 1991), there may be no threshold for the effects of lead (Schwartz 1994). The usual practice in most states is to respond environmentally and medically after an elevated blood lead level is detected, to prevent further exposure in the home and to hasten the elimination of lead from the body. Studies of parent education and household cleaning interventions to reduce elevated blood lead levels—the techniques most closely related to the prevention strategies used in the present study—have yielded mixed results depending on duration and intensity of the intervention, adequacy of controls, and other methodologic differences (Aschengrau et al. 1998; Charney et al. 1983; Haynes et al. 2002; Lanphear et al. 1996; Rhoads et al. 1999; U.S. EPA 1996). However, given that such interventions may occur too late to avoid long-term consequences to the child, it is most important to evaluate techniques that prevent lead burden in the first place. Limited data exist concerning the effectiveness of primary prevention techniques, and results appear to depend on the intensity and duration of education and cleaning strategies and on whether families or professionals are engaged in the preventive behavior (Lanphear et al. 1999, 2000b).

The purpose of this study was to assess the effectiveness of a culture-specific peer education program in preventing elevated blood lead levels in children during their peak period of risk for exposure. Although several outcome variables were measured, in this article we report the results of blood lead monitoring only. We hypothesized that more children of mothers in the intervention group would maintain lower blood lead levels than would children of mothers in the control group.

## Materials and Methods

The Phillips Lead Project was a community-based, randomized controlled trial of the effectiveness of intensive, culture-specific peer education in maintaining low blood lead levels in children from birth to 3 years of age. The project was designed and conducted in collaboration with residents of the Phillips Neighborhood in Minneapolis, Minnesota. Mothers were randomized to a control or intervention group. Regardless of group assignment, all participants received state health department brochures about lead, in their own language. Blood was drawn regularly for all children. All home environments were

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